



## ENGINE SYSTEMS, INC.

1220 S. Washington St., Rocky Mount, NC 27801  
P.O. Box 1928, Rocky Mount, NC 27802-1928

Telephone: 252/977-2720  
Fax: 252/446-1134

August 1, 2002

U.S. Nuclear Regulator Commission  
Document Control Desk  
Mail Stop 0P1-17  
Washington, DC 20555

Subject: 10CFR21 Reporting of Defects and Non-Compliance -  
Engine Systems, Inc. Report No. 10CFR21-0083, Rev. 0

Pistons used in EMD 645 series engines

Dear Sir:

The enclosed report addresses a reportable notification about pistons used in EMD 645 engines.

A copy of the report has also been sent to the NRC.

Please sign below, acknowledging receipt of this report, and return a copy to the attention of Document Control at the address above (or, fax to number 252/446-1134) within 10 working days after receipt.

Yours very truly,

ENGINE SYSTEMS, INC.

Susan Woolard  
Document Control

**Please let us know if ANY of your mailing information changes - name of recipient, name of company/facility, address, etc. Mark the changes on this acknowledgment form and send to us by mail or FAX to the number above.**

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**Report No. 10CFR21-0083**

Rev. 0: July 31, 2002

### 10CFR21 REPORTING OF DEFECTS AND NON-COMPLIANCE

COMPONENT: Pistons used in EMD 645 series engines

SYSTEM: EMD diesel generators

CONCLUSION: Reportable in accordance with 10CFR21.

PREPARED BY:

*[Signature]*  
Engineering Manager

DATE:

7/31/02

REVIEWED BY:

*Michael Auding*  
Quality Assurance Manager

DATE:

July 31, 2002

RECORD OF REVISIONS

PAGE: 1 of 1

REV	DATE	PAGE	DESCRIPTION

## **COMPONENT:**

Pistons used in EMD 645 series diesel engines.

## **SUMMARY:**

Engine Systems Inc. (ESI) has concluded our investigation of a condition reported with EMD pistons applicable to EMD 645 engines. The condition identifies casting flash material on the underside of the piston crown between the gussets (crown windows). The flash is a product of the piston manufacturing process when the piston cores are joined together. Internal parts of the piston are lubricated and cooled by the piston cooling oil. Cooling oil is directed through a drilled passage in the piston carrier and circulates about the underside of the piston crown area. Some of the oil lubricates the insert bearing and piston pin through an oil passage in the carrier and the remaining oil drains through two holes in the carrier located at the taper (refer to illustration on the next page). Any loose flash material that may become dislodged is carried by the oil through the piston carrier drain holes and settles at the bottom of the oil pan. The settled fragments are not of concern. There exists a concern, however, that a loose fragment could block the insert bearing oil passage and thus cause bearing damage. EMD has reported that no failures have been attributed to this condition (nuclear or commercial applications) to date.

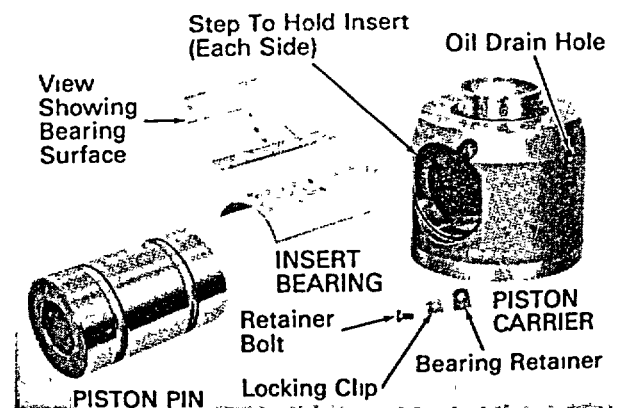
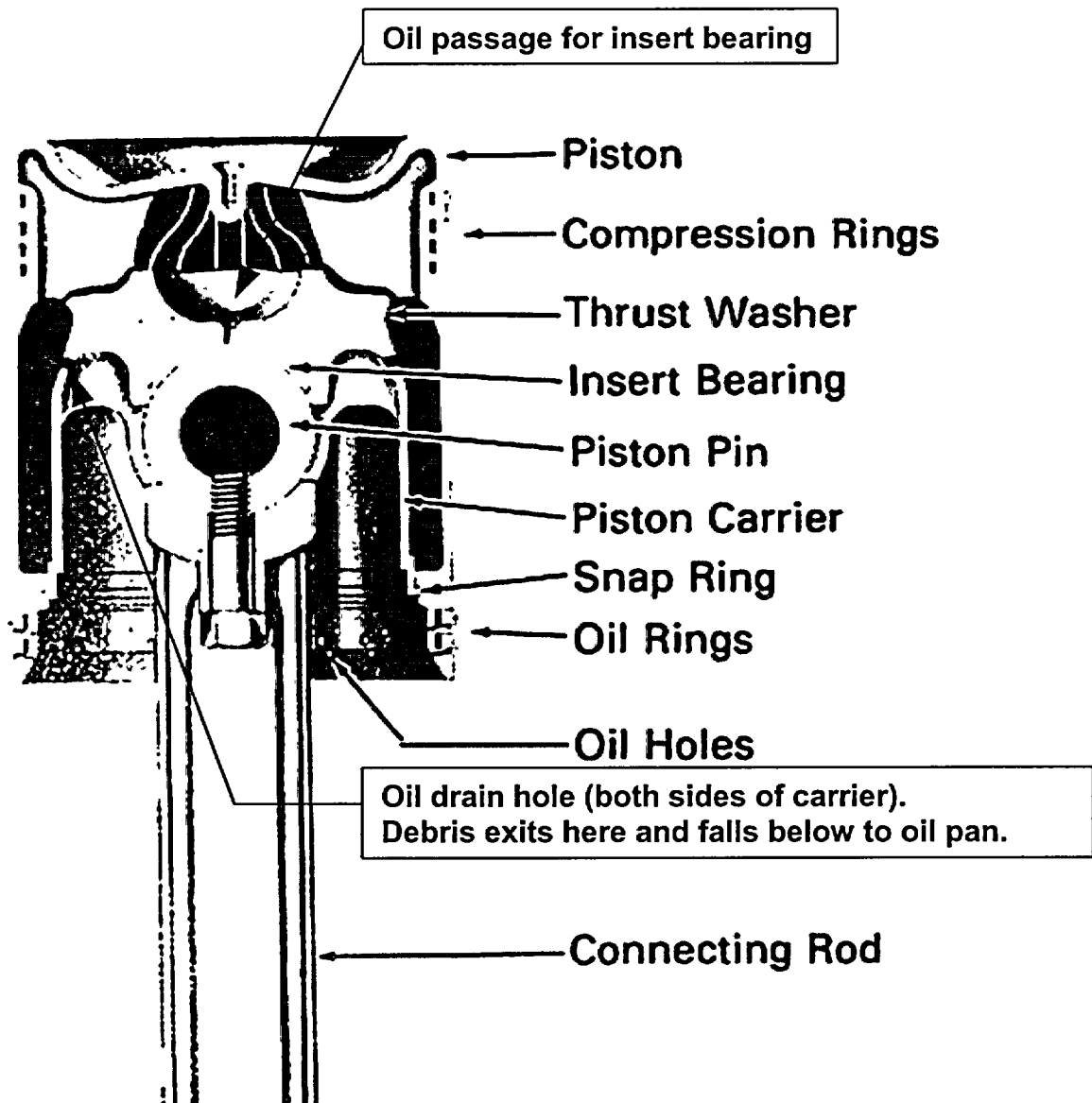
Three (3) occurrences have been reported to date:

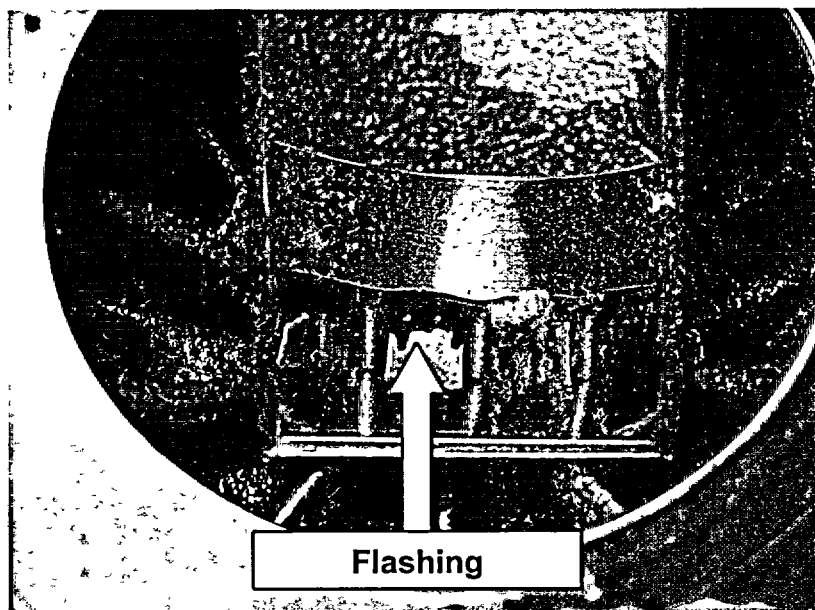
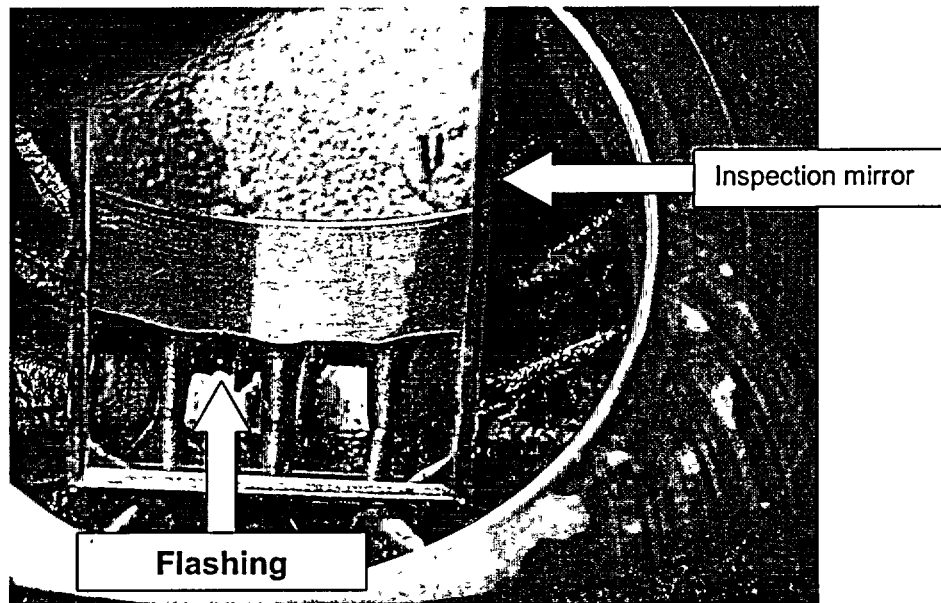
- Point Beach nuclear plant originally reported such a condition in January 2002. During maintenance activity when engine lube oil was removed, small metallic fragments (1/4" to 1/2") were recovered from the oil pan. Some of the fragments were located directly below cylinders 9 & 19. Subsequent inspection of the cylinder 9 & 19 power assemblies revealed flashing on the piston underside area near the piston crown webbing that broke away when touched by hand. The remaining 18 power assemblies were then removed for evaluation. Insert bearing inspections revealed no abnormal conditions relating to the metallic fragments. The pistons were supplied in 1999 as part of 20 complete power assemblies. 14 of the 20 assemblies had some degree of flash material with 10 of those exhibiting loose pieces that could be flaked off using a small hand tool. All pistons were identified with 1999 serial numbers. The flash condition was thought to be limited to this batch of pistons.
- During inspection of an EMD cylinder power assembly for Surry Nuclear Station, piston flashing was again noted under the piston crown. The power assembly was sent to ESI for failure analysis because of a coolant leak. The piston flashing was not related to the coolant leak issue. The Surry failure analysis was completed in May 2002. The piston was identified with a 1999 serial number. Only a partial power assembly was supplied for analysis and therefore the insert bearing was not available for evaluation at ESI.
- Recently (July 2002), Nine Mile Point reported metallic fragments in the engine oil pan. The fragments were located below 6 cylinders and resemble those found in the Point Beach engine. The pistons are identified with 1997 and 1998 serial numbers.

## **CONCLUSION:**

EMD has evaluated this issue with their supplier. The supplier has retrained their operators, finishers and inspectors on processes and procedures relating to the pistons. ESI has also added inspections for this condition as part of the Nuclear Dedication inspections for all EMD pistons. All pistons manufactured prior to 2/21/02 are considered suspect for the flashing material condition addressed above.

Because the potential exists that lubrication of the insert bearing could be impacted by loose piston flashing material, all users of EMD 645 engines are being notified.





**CUSTOMERS AFFECTED:**

It could not be determined when the piston flashing issue developed; therefore, this notification will be sent to all nuclear users with EMD 645 diesel engines.

**CORRECTIVE ACTION:**

1. **Monitor lube oil for trend of increasing silver levels.** Review previous lube oil analyses and perform a lube oil analysis after each surveillance run. If silver concentration increases 0.2 ppm or greater between runs or if silver concentration is greater than 1.0 ppm, perform lead wire readings. Perform insert bearing inspections for any cylinders with unacceptable lead wire readings. Piston underside crown inspection (see below) shall be performed as soon as possible if any cylinder has insert bearing damage that is attributed to flash material.
2. **Check oil pan for metallic fragments at earliest convenience** (see note below).
  - a. **If metallic fragments are discovered**, perform the following:
    - i. **Continue monitoring lube oil for any trend of increasing silver levels** (see above).
    - ii. **Perform piston crown inspections during next refuel outage.** Use an inspection mirror or boroscope to completely examine the underside of the piston crown. Flashing material that is tightly adhered and does not easily break off by exerting force from a finger or a hand held tool is considered acceptable.
  - b. **If metallic fragments are not discovered**, perform the following:
    - i. **Continue monitoring lube oil for any trend of increasing silver levels** (see above).

NOTE: Oil pan inspections are only required if new pistons (power packs) have been installed since the last oil pan inspection. If a previous oil pan inspection did not reveal any fragments and pistons (power packs) have not been changed-out, then an additional oil pan inspection is not required.